

AD-756 896

SEISMIC ARRAY ANALYSIS CENTER QUARTERLY  
TECHNICAL SUMMARY REPORT. OCTOBER -  
DECEMBER 1972

William Dean

Teledyne Geotech

Prepared for:

Advanced Research Projects Agency

19 January 1973

DISTRIBUTED BY:

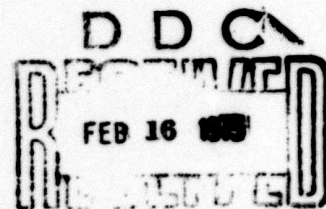
**NTIS**

National Technical Information Service  
U. S. DEPARTMENT OF COMMERCE  
5285 Port Royal Road, Springfield Va. 22151

AD756896 ✓



.....contributing to man's  
understanding of the environment world



# SEISMIC ARRAY ANALYSIS CENTER QUARTERLY TECHNICAL SUMMARY REPORT OCTOBER - DECEMBER 1972

JANUARY 19, 1973

Prepared for  
**AIR FORCE TECHNICAL APPLICATIONS CENTER**  
Washington, D.C.

Under  
**Project VELA UNIFORM**

Sponsored by  
**ADVANCED RESEARCH PROJECTS AGENCY**  
Nuclear Monitoring Research Office  
ARPA Order No. 1620

Reproduced by  
**NATIONAL TECHNICAL  
INFORMATION SERVICE**  
U S Department of Commerce  
Springfield VA 22151

 **TELEDYNE GEOTECH**  
ALEXANDRIA LABORATORIES

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED.

13 R

ADD SECTION		
RTIS	White Section	<input checked="checked" type="checkbox"/>
D G	Buff Section	<input type="checkbox"/>
UNCLASSIFIED		<input type="checkbox"/>
JUSTIFICATION		
BY		
DISTRIBUTION/AVAILABILITY CODES		
Dist.	AFAIL. and/or SPECIAL	
A		

*Neither the Advanced Research Projects Agency nor the Air Force Technical Applications Center will be responsible for information contained herein which has been supplied by other organizations or contractors, and this document is subject to later revision as may be necessary. The views and conclusions presented are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the Advanced Research Projects Agency, the Air Force Technical Applications Center, or the U S Government.*

Unclassified

Security Classification

DOCUMENT CONTROL DATA - R&D		
(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)		
1. ORIGINATING ACTIVITY (Corporate author) Teledyne Geotech Alexandria, Virginia		2a. REPORT SECURITY CLASSIFICATION Unclassified
		2b. GROUP
3. REPORT TITLE SEISMIC ARRAY ANALYSIS CENTER QUARTERLY TECHNICAL SUMMARY OCTOBER - DECEMBER 1972		
4. DESCRIPTIVE NOTES (Type of report and inclusive dates) Scientific		
5. AUTHOR(S) (Last name, first name, initial) Dean, William		
6. REPORT DATE 19 January 1973	7a. TOTAL NO. OF PAGES 11	7b. NO. OF REFS
8a. CONTRACT OR GRANT NO. F33657-72-C-0471	8b. ORIGINATOR'S REPORT NUMBER(S)	
b. PROJECT NO. VELA T/2709		
c. ARPA Order No. 1620	9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)	
d. ARPA Program Code No. 2F10		
10. AVAILABILITY/LIMITATION NOTICES  APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED.		
11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY Advanced Research Projects Agency Nuclear Monitoring Research Office Arlington, Virginia 22209	
13. ABSTRACT		
14. KEY WORDS		

I

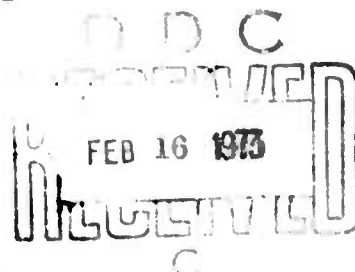
Unclassified

Security Classification

SEISMIC ARRAY ANALYSIS CENTER  
QUARTERLY TECHNICAL SUMMARY REPORT

October - December 1972

AFTAC Project Number:	VELA T/2709
Project Title:	Seismic Array Analysis Center
ARPA Order No.:	1620
ARPA Program Code No.:	2F10
Name of Contractor	TELEDYNE GEOTECH
Contract No.:	F33657-72-C-0471
Effective Date of Contract:	1 January 1972
Amount of Contract:	\$1,663,848
Contract Expiration Date:	30 June 1973
Project Manager:	William C. Dean (703) 836-3882



P. O. Box 334, Alexandria, Virginia

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED.

## TABLE OF CONTENTS

	Page No.
INTRODUCTION	1
TASK A - OPERATE SAAC	1
Operation	2
Documentation and Programming	3
ARPANET	3
Data Requests	3
TASK B - EVALUATION	4
TASK C - LASA/NORSAR COMPARISON	4
TASK D - LP NETWORK EVALUATION	5
WWSSN STUDY	5
PROBLEMS ENCOUNTERED	6

## INTRODUCTION

*5. The*  
This quarterly report summarizes the operations and accomplishments in the SAAC for the period of October, November and December 1972. *Included are SAAC operation, evaluation, documentation, and programming, and data requests.*

### TASK A - OPERATE SAAC

#### Operation

The SAAC Detection Processor (DP) and Event Processor (EP) were run with constant parameter settings, 24 hours a day, seven days a week during this period.

Table I shows the DP uptime and downtime as well as the general problem categories causing the downtime. The above normal downtime in December was due to high error rates on the 50K bit line and hardware problems at Billings (18 hours).

Table II shows the EP and analyst time required to review and edit DP detections.



<u>Month</u>	October	November	December	Total
	(in hours)			
<u>Problems</u>				
Hardware	6.2	1.4	1.6	9.2
Software & Testing	10.4	8.8	11.1	30.3
Power Failure	0.2	1.8	-	2.0
50 KB Line	6.0	3.7	48.3	58.0
Preventative Maint.	4.2	3.1	5.0	12.3
<hr/>				
Total DP Downtime	27.0	18.8	66.0	111.8
Total DP Uptime	717.0	701.2	678.0	2096.2
% Uptime	96.5	97.5	91.3	94.9
Total Possible	744	720	744	2208

Table I. DP ISRSPS Up-Downtime for LASA Data  
in 4th Quarter 1972



Month	October	November (in hours)	December	Total
DP Recording Time Covered by EP Analysis	716.6	701.1	678.0	2095.7
Analyst Time Required on EOC	84.1	108.9	125.9	318.9
IBM 360/40B Time Required on EP	292.9	335.4	369.5	997.8

10

No. of Detections	12798	14130	16182	43110
No. of Events Listed on Summary	591	645	881	2117

Table II. DP-EP Analysis Time in 4th Quarter 1972

### Documentation and Programming

During this quarter coding changes were made to the off-line DP and support programs to allow array size experimentation. Several different combinations of subarrays and sensors have been run and the data are now being analyzed.

Modification set 08 (M08) to the EP system has been completed and is ready to be installed in the on-line version. This will probably be done in early January. Besides the functional changes listed below, M08 also completes a modification to the Event Data Set Directory which was part of M05 and segmentation of rerun and EOC processors to reduce their total core requirements. This will facilitate planned development.

- 1). End of plot tape recognition. This will assist operations in plotting the proper number of files.
- 2). Beampacking convergence minimum number of iterations increased to 5.
- 3). Addition of velocity and azimuth to the Detection File Report.
- 4). Modification of the 2260 mask display for adding Detection Bulletin File lines via the 2260.
- 5). End-of-tape handling in abnormal termination processing in SP03. This should insure that trailer labels are written on all event tapes.
- 6). Prevention of invalid data base shifts in SP3 (SP02)
- 7). Elimination of errors caused by computed depths greater than 250 kilometers; addition of phase velocity and azimuth to Event Summary Report for events that fail in Event

## Characterization.

- 8). Prevention of errors in obtaining High Rate Tape numbers at year change.

Documentation for these changes has been generated in draft form and will be included in the next set of updates to the ISRSPS manuals.

## ARPANET

The interface hardware being built by University of California at Santa Barbara (UCSB) is expected to arrive on February 12, 1973. We are developing a Data Transfer Module (DTM), a program which will allow file transfer from 360/44 peripherals through the UCSB interface to some distant host on the ARPANET. Expected completion date for the DTM is April 1973.

We have made changes to our LP analysis program, FKCOMB, to enable it to run on 360/OS computer such as the UCLA 360/91.

This program now resides on disc at the 360/91 but the 360/OS version still had some bugs as of the end of December 1972.

Other activities include training our staff on the available capabilities and establishing protocol with other ARPANET computer centers.

## Data Requests

During the quarter 575 requests for data were completed. Of those 427 were for MIT Lincoln Laboratories, 91 for Texas Instruments, 40 for Alexandria Laboratories, 8 for University of Texas at Dallas and 9 for the University of California at San Diego. NORSAR Event Tapes from 15 February 1971 through 13 September 1972 were copied and sent to Lincoln Lab. Routine copying of each Tuesdays NORSAR and ALPA long period data for Lincoln Lab are

complete through October 1972. At the end of the quarter 278 data requests were outstanding. Thirty four requests were cancelled during the quarter due to unrecoverable data.

#### TASK B - EVALUATION

During the last quarter we reprocessed off-line two days of data which had been processed and extensively analyzed (all signals over 10 db) by the on-line system. The objective is to change the system parameters off-line and compare the signal detection and false alarm performance with those of the standard, parameter settings.

System parameter variations include:

- a). The number of elements per subarray at LASA (16 standard, 13, 10, and 7 sensors per subarray).
- b). The number of subarrays at LASA (E-ring and C-ring beams are standard; D-ring beams are under test).
- c). Different detection filters.
- d). Different detection algorithms including a square law and a Fisher detector.

In the third quarter we had problems getting the off-line DP program to work. During this past quarter we successfully debugged the program and analysis is proceeding.

#### TASK C - LASA/NORSAR COMPARISON

A total of eleven (11) EP reruns were processed during this period. These are events based on NORSAR bulletin, where detections were reported at LASA but rejected due to below EP threshold. The result of these reruns rejected 3 S. Fiji Island area events,

indicating NORSAR bulletin events in this area (based on PKP) are not confirmed. The rest of 9 events from other areas are confirmed by analysts.

Draft preparation of this study continued during this period but the majority of the time is taken away by another priority project. We expect this report will be completed in next period.

#### TASK D - LP NETWORK EVALUATION

About 120 Asian events recorded at NORSAR and ALPA have been processed with FKCOMB.

These data are now being compiled in order to estimate relative detection threshold for surface waves.

A complete LP analysis of all events recorded during the International Seismological Month (Feb 20 - March 19 1972) is approximately three quarters complete.

#### WWSSN

At government request a special study was conducted on upgrading the World Wide Standard Station Network. The study of 50 selected stations included noise measurements and characteristics, detection capability, recommendations for hardware upgrading, projected seismic magnifications for both long-period and short-period sensors; and diagrams and cost/performance comparisons of the various methods of up-grading.

PROBLEMS ENCOUNTERED

In order to keep the DP system operating successfully it has become necessary to temporarily eliminate the transmission of data to NORSAR. At first this was believed to be a hardware problem. However, after hardware corrections the DP system would only stay up for approximately 10 hours before termination. Recent investigation indicates that the problem might be that of storage allocation which must be balanced against system load.

Efforts are being made (under high priority) to determine what must be done.